

Cleaning: removing nano-size particles from plastic electronics

Interview with Sheila Hamilton, Technical Director of Teknek.



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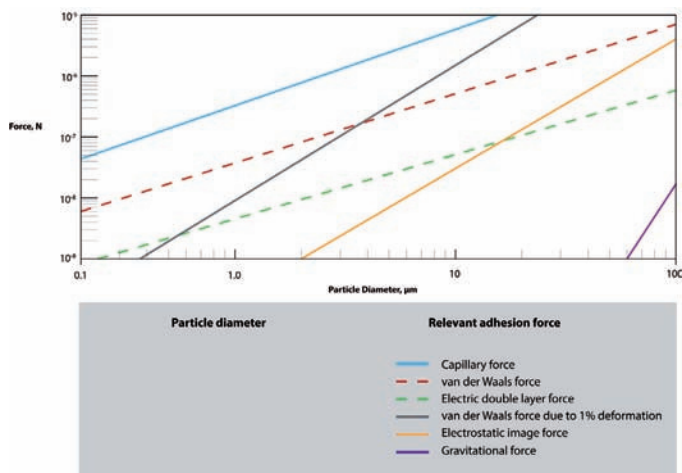
1. NANOCLEEN™ IS THE TECHNOLOGY YOU HAVE DEVELOPED TO CLEAN PLASTIC ELECTRONICS. WHAT IS NANOCLEEN™? Nanocleen™ is a different type of elastomer compared to the conventional contact cleaning elastomers, which have been around for a long time. It is a special formulation that we have developed. We do a surface modification to it, which enables it to pick up a range of particles including very small nano sized particles. That is also where it differs from conventional contact cleaning technology.

2. FROM THE CLEANING PERSPECTIVE, HOW DO YOU DEFINE PLASTIC ELECTRONICS? Plastic electronics is where any electronics circuitry is put on a plastic substrate, but it could also apply to printed electronics where it can be on a plastics substrate, or on a metal foil or on a conventional PCB, or it could be flexible electronics. All three things overlap and Nanocleen™ technology can work on all of these three.

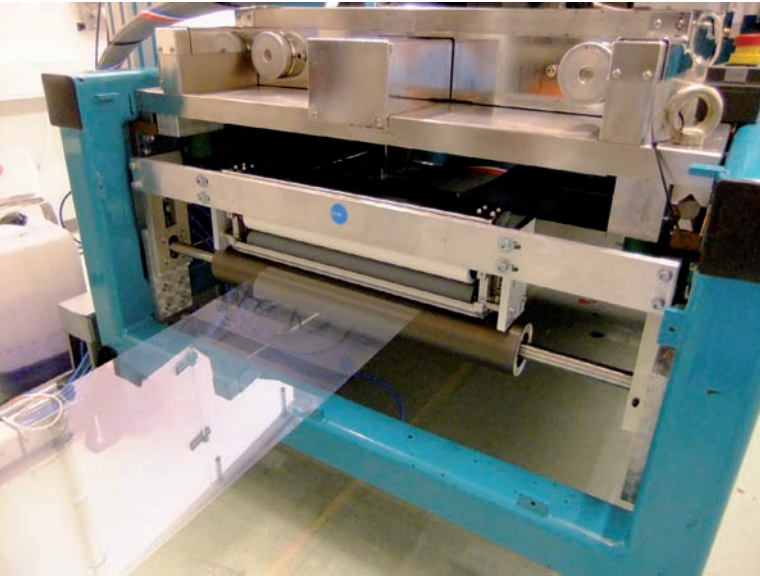
3. WHERE IN THE PRODUCTION PROCESS MUST CLEANING TAKE PLACE AND WHY? The first place where you should clean a substrate is when it is being unwound prior to processing it. Because, even if the provider of the substrate has cleaned prior to winding, during transport it moves and it can release particles. So, you should always clean at the unwind station. This is ideally situated as close as possible to the actual process such as coating, printing or laminating. Again, the substrate should be cleaned at the end of the process prior to winding. Anything that is trapped in the wind of the substrate can cause a repeating defect throughout the roll. Most of the plastic electronics and flexible electronics lines will provide cleaning right at the start and right at the rewind. This is sufficient as the line is a continuous short line leading right to the finished product. It would be different for a wide web application where people are preparing the substrate with e.g. ITO, cleaning would also take place in the vacuum chamber prior to deposition of the ITO as well as after unwinding and prior to winding.

4. WHAT GRADE OF CLEAN IS NECESSARY FOR PLASTIC ELECTRONICS? This depends on the kind of electronics that you are trying

to print. If you were doing a relatively broad tracked sensor, you would always need to clean to the size of particles that are the size of half the width of the conductive track. Particles that are larger than half the size of the conductive track will compromise functionality of the sensor. Particles smaller than half the size of the track will not pose these problems. For thin film transistors or for displays you will need to clean down to nano scale particles. The «clean4yield project», in which I am involved, has the target to remove particles the scale of 100 nanometres.



5. HOW WAS NANOCLEEN™ DEVELOPED? Development was initiated in a project called «highsurf». It was a British funded project on making high quality surfaces for printed electronics. It was a project with just 3 partners: DuPont Teijin Films, who made the substrate, ourselves who were cleaning it and Plastic Logic, a plastic electronics display manufacturer. The goal was to develop a process whereby the substrate Plastic Logics received was clean enough to allow them to manufacture displays. At the end of 3 years, Plastic Logic was in the position to make the displays, due to the substrate being cleaned by us in the DuPont facility and again at the Plastic Logic facility at the start of the processing. After this project finished, we became involved in the European funded project, Clean4yield. It is under PF7, Nanomaterials. The scope is much wider: cleaning, inspection and repair of circuits. The emphasis is on contamination removal, but also on how you know that there is contamination in the first place, and how a defect caused by contamination can be repaired.



Nanoclean™ before coating head

6. WHAT IS TEKNEK'S ROLE IN THIS PROJECT? There are seven different working parties within this project. Teknek are currently leading the working party dealing with cleaning of the substrates. And we are also heavily involved in another work group called «prevention». It has the goal to prevent contamination of the substrate in the first place, for example by cleaning the factory environment, the machinery and equipment used, or just setting up best practice procedures. Of course Teknek equipment is also running on the demonstration lines that are being built as part of the project.

7. WHAT IS THE STATUS OF THE PROJECT? The project will run another 5 months until May. It is very close to completion. All the initial research work has been done, which includes improving the Nanoclean™ technology from where it was at the end of high-surf. We have also developed some other techniques during this time which have enabled us to meet the requirements of the project, i.e. to be able to clean down to 100 nanometres on a web width of 300 mm but scalable up to a meter and going at a speed of between 5 and 10 meters per minute no contamination or cross without contamination or crosscontamination and without changing the surface energy. This is one of the key advantages Nanoclean™ has, that it does not change the surface energy. This is vital when there is a very thin coating on the substrate.

8. WHICH CHALLENGES STILL LIE AHEAD UNTIL THE PROJECT IS COMPLETED? From Teknek's perspective we have achieved most of what we have wanted to achieve. The objective is that we want to see our technology running on the three or four production lines: for flexible OLEDs, for flexible TV and also OLEDs based on glass. Phillips is one of the members of the projects and they are making OLEDs on glass. There is a range of substrates we have been cleaning, not just plastic films and ITO, we have been cleaning PEDOTT, which people were very concerned that we would not be able to clean it, as it is very sensitive. And also the photo-active layers are being cleaned by Teknek without delaminating or damaging them or without changing the surface energy in any way. ⚡

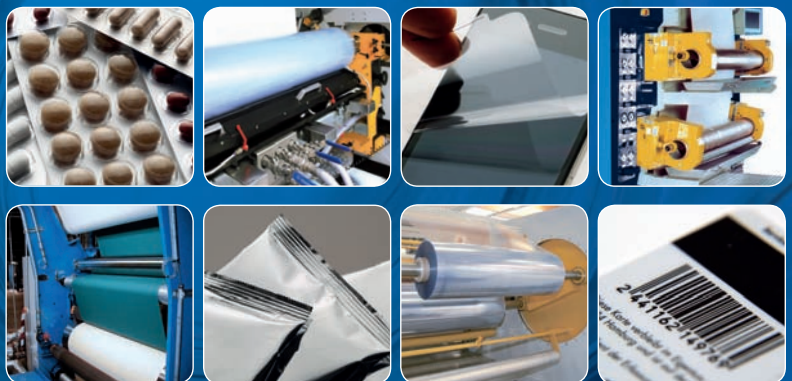
MRS HAMILTON, THANK YOU VERY MUCH FOR THE INTERVIEW.

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